

Electrical Power Engineering (2)

Code: EP2207

Lecture: 4

Tutorial: 4

Total: 8

Dr. Ahmed Mohamed Azmy

Department of Electrical Power and Machine Engineering

Tanta University - Egypt



Faculty of
Engineering



Tanta University

Cost ratio for double circuit installations

Voltage	132 kV	275 kV	400 kV
One km overhead line	51,000	136,000	262,000
One km underground	456,000	1,775,000	5,140,000
Ratio	9	13	20

Multicore Cables, with Flexible Copper Conductors PVC Insulated and PVC Sheathed

Description

- Soft annealed Copper fine wires, bunched together in sub units or stranded bunched groups into a main units, which forms the flexible conductor. These conductors are insulated with PVC compound rated 70 °C and sheathed with PVC compound layer.
- Cables are produced according to IEC 60227 or BS 6500.

Application

- For indoor movable installation in dry location connecting to source power portable electrical appliances operating under unfavorable conditions, such as portable lamps, fans, refrigerators, washing machines, vacuum cleaners, TV & house hold heating and ventilating apparatus.



Egytech - code	Number & cross sectional of conductors	Maximum diameter of wires	Max. Conductor resistance		Current rating in air		Approx. overall diameter	Approx. weight
			DC at 20 °C	AC at 70 °C	Lain in free air	Lain in conduits		
	nr x mm ²	mm	Ω/km	Ω/km	A	A	mm	kg/km
CPC-F102-U02	2 x 0.75	0.21	26.00	31.60	11	8	6.2	56
CPC-F102-U03	2 x 1.0	0.21	19.50	23.40	13	10	6.5	64
CPC-F102-U04	2 x 1.5	0.26	13.30	15.95	16	13	7.6	88
CPC-F102-U06	2 x 2.5	0.26	7.98	9.56	22	18	9.4	138

Multicore Cables, with Stranded Aluminium Conductors, PVC Insulated and PVC Sheathed

Description

- Multicore cables of stranded Aluminium conductors are insulated with PVC compound, assembled together, covered with overall jacket of PVC compound.
- Cables are produced according to IEC 60502 or BS 6346.

Application

- For outdoor and indoor installations in damp and wet locations.



Egytech - code	Nominal cross sectional area	Max. Conductor resistance		Current rating			Approx. overall diameter	Approx. weight
		DC at 20 °C	AC at 70 °C	Laid direct in ground	Laid in ducts	Laid in free air		
	mm ²	Ω/km	Ω/km	A	A	A	mm	kg/km

Two core cables

AP1-T102-U10	10 mm	3.080	3.300	46	39	46	15.8	360
AP1-T102-U11	16 mm	1.910	2.290	60	46	62	17.9	330
AP1-T102-U12	25 mm	1.200	1.440	77	60	81	21.3	435
AP1-T102-U13	35 mm	0.868	1.040	103	83	114	23.5	505

Three core cables

AP1-T103-U10	10 mm	3.080	3.300	42	34	37	16.9	320
AP1-T103-U11	16 mm	1.910	2.290	53	42	50	19.0	405
AP1-T103-U12	25 mm	1.200	1.440	70	56	66	22.7	570

Multicore Cables, with Stranded, Aluminum Conductors, XLPE Insulated and PVC Sheathed

Description

- Multicore cables of stranded Aluminium conductors are insulated with XLPE compound, assembled together and covered with an overall jacket of PVC compound.
- Cables are produced according to IEC 60502 or BS 5467

Application

- For outdoor and indoor installations in damp and wet locations. They are normally used for power distribution in urban networks, in industrial plants, as well as in Thermopower and Hydropower stations.



Egytech - code	Nominal cross sectional area	Max. conductor resistance		Current rating			Approx. overall diameter	Approx. weight
		DC at 20 °C	AC at 90 °C	Laid direct in ground	Laid in ducts	Laid in free air		
	mm ²	Ω/km	Ω/km	A	A	A	mm	kg/km

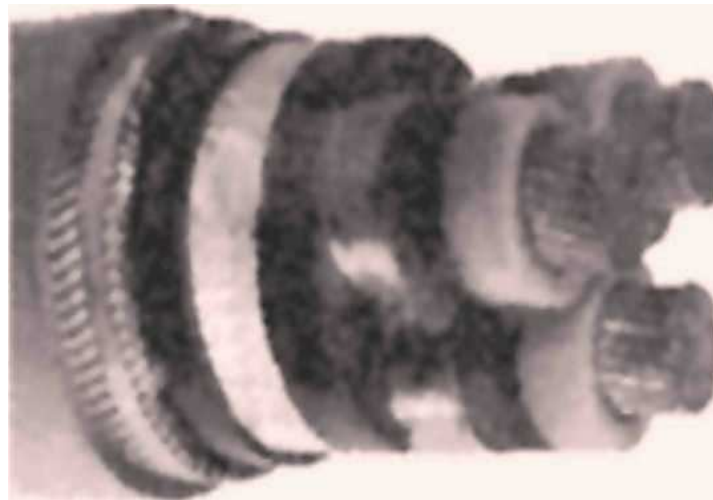
Two core cables

AX1-T102-U10	10 mm	3.080	3.950	57	48	55	14.7	335
AX1-T102-U11	16 mm	1.910	2.450	74	58	73	16.7	450
AX1-T102-U12	25 mm	1.200	1.540	97	75	97	20.1	640
AX1-T102-U13	35 mm	0.868	1.113	128	106	120	22.3	780

(a)

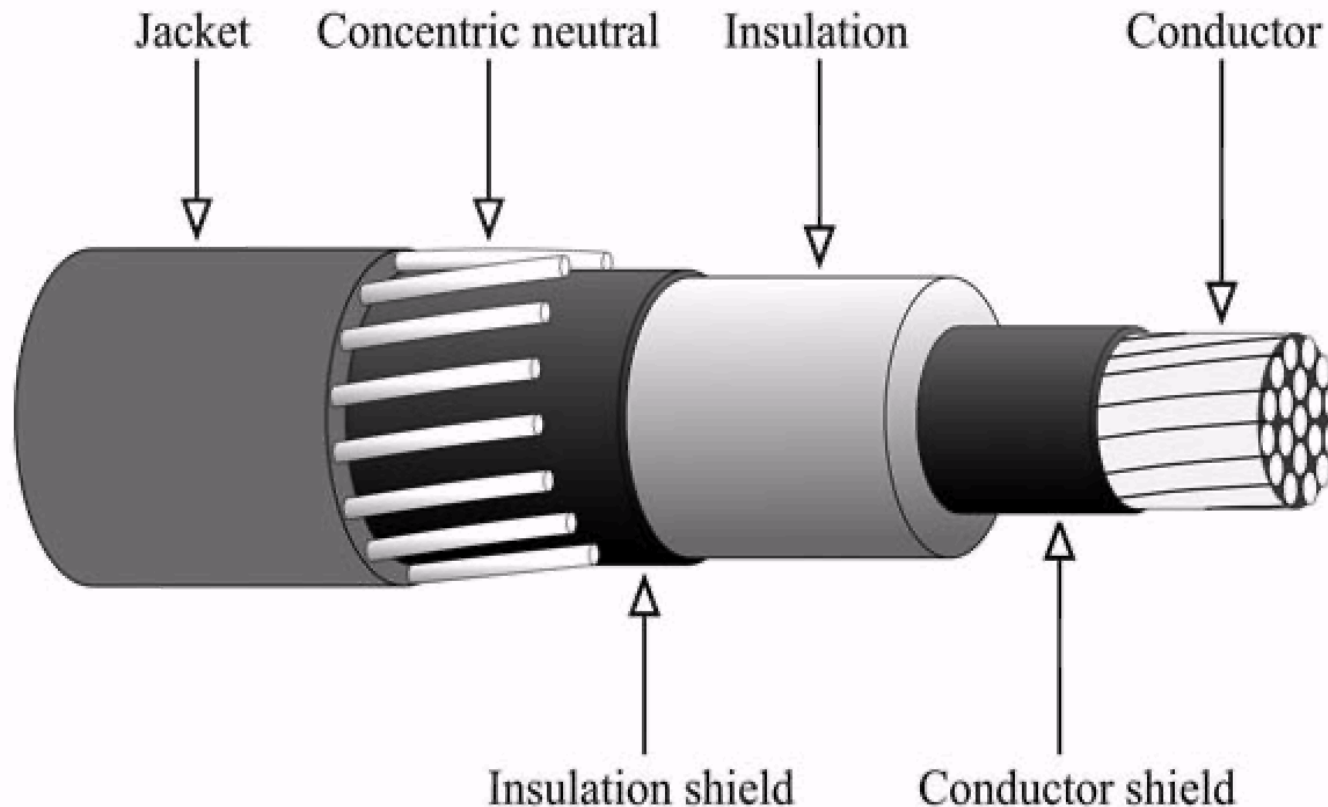


(b)



Elements of typical (a) single-core and (b) three-core, steel armoured, insulated power cables.

Two main types of cable are available: concentric-neutral cable and power cable. Concentric-neutral cable normally has an aluminium conductor, an extruded insulation, and a concentric neutral.



Conductor Diameters

	Solid	Class B stranding	
Size	Diameter, in.	Strands	Diameter, in.
24	0.0201	7	0.023
22	0.0253	7	0.029
20	0.032	7	0.036
19	0.035	7	0.041
18	0.0403	7	0.046
16	0.0508	7	0.058

Cable Insulation

Paper

Natural rubbers (NR)

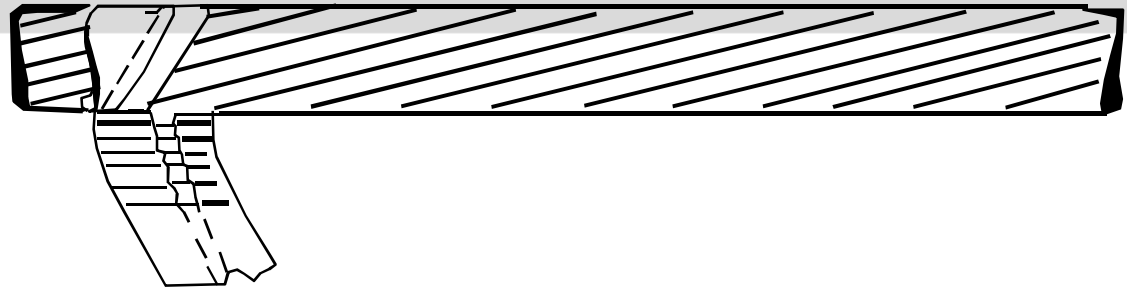
Silicone rubber (SR)

butyl rubber (BR)

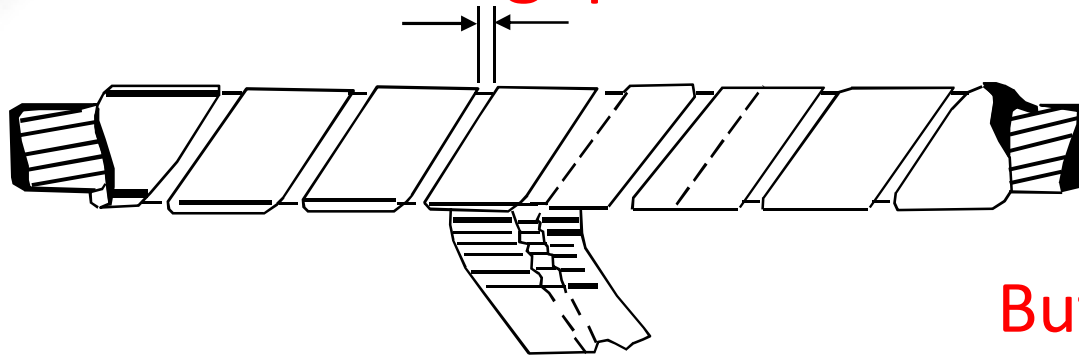
Ethyl vinyl acetate (EVA)

Ethylene propylene (EP or EPR)

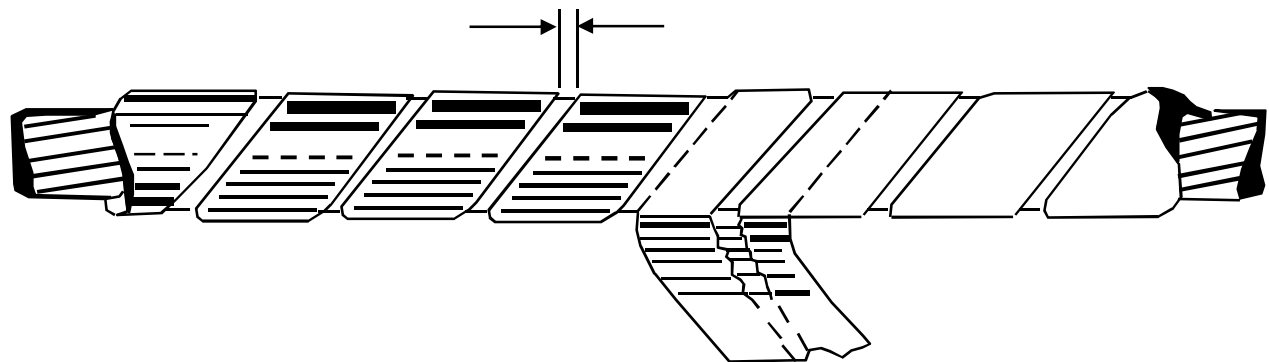
Cross-linked polyethylene (*XLPE* or *XLPE*)



Butt gap



Butt gap



key properties of cable insulation

- Dielectric constant " ϵ " (also called permittivity)
 - Volume resistivity
 - Dielectric losses
 - Dissipation factor (also referred to as the loss angle, loss tangent, $\tan \delta$, and approximate power factor):
-